II. Overview of Technology Transfer and the DOD

Technology Transfer (TT) is the exchange of technology between the public and private sector, between the federal agencies and academia, or any combination thereof. TT includes[9] spin-off, dual-use, and spin-on activities that allow DoD programs to make the best possible use of national scientific and technical capabilities as well as provide technologies for non-defense applications. TT is also envisioned to incorporate innovative technology into military systems as well as to meet mission needs at a lower acquisition cost by taking advantage of the economies of scale by purchasing from a larger industrial base.

Policy guidance for DoD Domestic Technology Transfer and Dual-Use Technology Development (DTT/DUTD) initiatives was introduced in a June 1995 Secretary of Defense memo. The memo lays out the formal DoD policy on DTT/DUTD issues. "DoD Domestic Technology Transfer/Dual Use Technology Development (DTT/DUTD) are integral elements of the Department's pursuit of its national security mission. They must have a priority role in all DoD acquisition programs and must be recognized as key activities of the DoD Labs."[4] For laboratories, the memo states: "All DoD labs, as defined by 15 U.S.C. §3710a(d)2, and other organizations responsible for RDT&E activities must make DTT/DUTD a priority element in the accomplishment of their science and technology programs."

Other observers have also noted that profound political, budgetary and technological trends are creating a new paradigm for greater technology partnering between labs and industry. Dr. Janet S. Fender of the Air Force Research Laboratory, Kirkland AFB, indicated at the 1996 FLC National Technology Transfer Meeting in Albuquerque, NM, that a number of DoD professionals in technology transfer, RDT&E policymakers, and managers acknowledge that a changing paradigm in DoD S&T (See Figure 1) is under way.

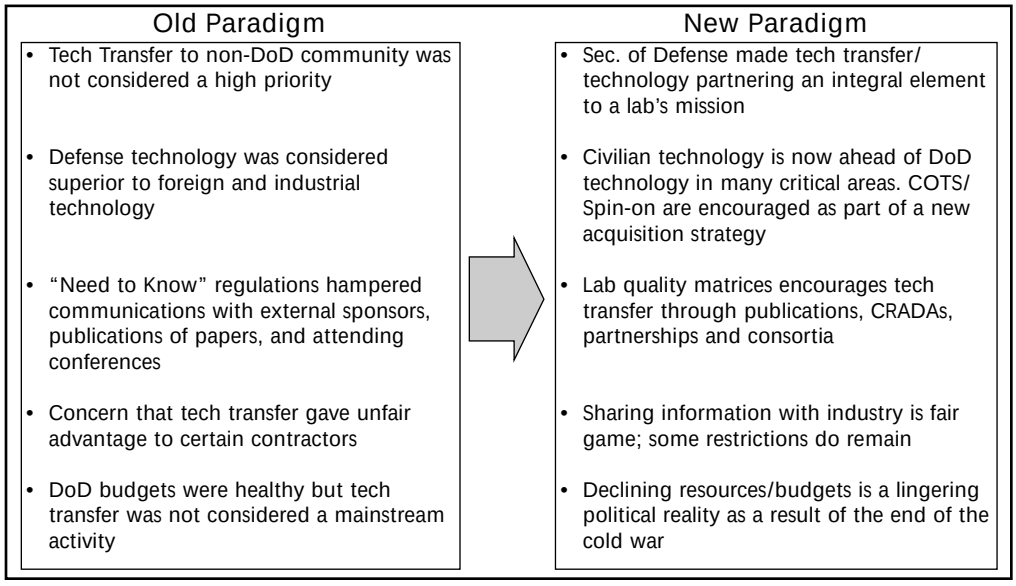


Figure 1. DoD Culture: Old and New

The DoD laboratories are also struggling to deal with technological shifts in the national climate. As a result of massive private sector advances and investments, the commercial sector is far ahead of the DoD in some critical information technologies. A Defense Science Board - Lab Management (DSB-LM) Interim Report[10] states that: "The laboratory system has not kept pace with the changing patterns of technology generation. No longer does the Defense Department

drive all militarily critical, cutting edge technologies. American industry, universities, and other government agencies play significant roles. The laboratory system must also develop a strategy for coping with fewer resources...."

The report goes further to state that "Labs, particularly for S&T functions, must maximize opportunities for collaborative interaction of government staff with their counterparts in other labs (e.g. NASA, DOE, DoC), industry and academia....Lab Directors must continuously search for technological, intellectual, and operational solutions outside the confines of their lab's mission and technical competence...."

The report identifies and recommends TT and partnering activities as important to laboratory modernization. "Labs should have a formal program to exploit all available mechanisms for S&T "spin-out, spin-in, and spin-up" in appropriate areas. Such mechanisms include CRADAs, grants, and cooperative agreements, collaborative proposals... contractual provisions for joint R&D, facility sharing, as well as personnel interactions essential to the transfer of tacit technology. To make such programs effective, Defense labs must earn the trust and respect of university and industrial partners; labs are a sponsor and collaborator, and should neither be, nor be seen as, a competitor. Labs also must promote the transfer to industry of their codified technology through patents, copyrights and licenses."

Similarly, "In an era of shrinking budgets and expanding global competition for cutting edge technology, the Air Force believes, and industry agrees, that government and industry R&D coordination is essential for the advancement of technologies integral to continued US strategic leadership."[11]

In addition, the intent of Congress has remained essentially the same for many years: leveraging federal R&D dollars for the greater good of the economy. The expectation has been that more partnerships between industry and Federal labs would improve U.S. competitiveness, help small businesses, and create new jobs and products for the nation's economy. Therefore, the FY93 Defense Authorization Act established the Office of Technology Transition within the Office of Secretary of Defense to ensure "that technology developed for national security purposes is integrated into the private sector of the United States in order to enhance national technology and industrial base, reinvestment, and conversion activities...."[3]

As illustrated in the Secretary of Defense memorandum, the OSD clearly encourages TT activities to promote cost sharing of DoD R&D through dual-use initiatives; integration of commercial technology through "spin-on" mechanisms, as well as making existing technology more affordable and accessible through spin-offs.[4]

Technology Transfer Legislation Related to CRADAs

The Stevenson-Wydler Technology Innovation Act of 1980 is one of the cornerstones of technology transfer. CRADAs, created as part of the Stevenson-Wydler Act and extended to DoD in 1989, are a visible symbol of increased industry-government cooperation. The CRADA mechanism is just one mechanism from which technology transfer can be accomplished.

Although there are several pieces of legislation that pertain to issues related to technology transfer, only those related to CRADAs will be mentioned as background for this study. In addition to the Stevenson-Wydler Technology Innovation Act of 1980, the Federal Technology Transfer Act of 1986 (TTA), Executive Order 12591: Facilitating Access to Science and Technology, the National Technology Transfer and Advancement Act of 1995, or the Morella Act, and the pending Technology Transfer Commercialization Act of 1998 are legislation specific to CRADAs.

Legislation Specific to CRADAs

- Stevenson-Wydler Technology Innovation Act of 1980 (PL 96-480)
- Federal Technology Transfer Act of 1986 (PL 99-502)
- Executive Order 12591, The Facilitating Access to Science and Technology
- National Technology and Advancement Act of 1995 (Morella Act) (PL 104-113)
- Technology Transfer Commercialization Act of 1999 (H.R. 209) (pending)

The Stevenson-Wydler Technology Innovation Act of 1980[12] directed the Secretary of Commerce to improve the economic, environmental, and social well-being of the United States by promoting technological development. The Act appointed an office within the DoC to serve as a clearinghouse for federally-owned or originated technical information with potential application in state or local government or private industry. This Act also established the Offices of Research and Technology Applications (ORTAs) at each Federal agency to coordinate and assist with transferring federal technologies, products, and services to the private sector.

The Federal Technology Transfer Act of 1986[13] amends the Stevenson-Wydler Technology Innovation Act of 1980 to authorize Federal agencies to permit the directors of their Government-operated Federal laboratories to enter into CRADAs with other Federal agencies, state or local governments, industrial organizations, non-profit organizations, consortia, academic institutions, and other persons. The Act also allows for the negotiation of patent licensing agreements. For the purposes of CRADAs, the Act requires Federal agencies to make separate determinations of the missions of each laboratory and dictates that the activities carried out under the auspices of technology transfer be consistent with mission responsibilities.

The Act authorizes Federal laboratories under CRADAs to: 1) accept, retain, and use funds, personnel services, and property from collaborating parties and provide personnel services and property to collaborating parties; 2) grant patent licenses or assignments, or options, in any subject invention made by a federal employee, or made jointly by a federal employee and an employee of the collaborating party, and to retain such rights as the laboratory deems appropriate; 3) waive, subject to reservation by the Government of a nonexclusive, irrevocable, paid-up license to practice the invention or have the invention practiced throughout the world by or on behalf of the Government, in advance, in whole or in part, any right of ownership which the Federal government may have to any subject invention made by a collaborating party or such party's employee under the agreement; and 4) to the extent consistent with applicable agency requirements, permit employees or former employees of the laboratory to participate in efforts to commercialize inventions they made while in the service of the United States. The act also sets forth rules and formula for the distribution of royalties received by Federal agencies from the licensing of inventions.

Executive Order 12591: Facilitating Access to Science and Technology[14] encourages the facilitation of CRADAs with other Federal labs, state and local governments, universities, and the private sector in order to assist in the transfer of technology to the marketplace. It also establishes requirement for review of CRADAs with foreign persons or industrial organizations.

The National Technology and Advancement Act of 1995,[15] or the Morella Act, addresses intellectual property issues arising from CRADAs. Under the Morella Act, a laboratory may grant, or agree to grant in advance, to a collaborating part, patent licenses, assignments, or options in any invention made in whole or in part by a laboratory employee under the agreement, for reasonable compensation when appropriate. Under the CRADA, the laboratory will assure that the collaborating party has the option to choose an exclusive license for a pre-negotiated field of use for any such invention under the agreement or, if there is more than one collaborating party, that the collaborating parties are offered the option to hold licensing rights that collectively encompass the rights that would be held under such an exclusive license by one party. In addition, the collaborating party may retain title to any invention made solely by its employee in exchange for normally granting the Government a nonexclusive, nontransferable, irrevocable, paid-up license to practice the invention or have the invention practiced throughout the world by or on behalf of the Government for research or other Government purposes.

Technology Transfer Commercialization Act of 1999 (pending)[16] improves the ability of Federal agencies to license federally owned inventions by allowing collaborating parties in a CRADA, access to the rights of pre-existing technology performed in the technical area encompassing the CRADA without requiring advertisement of the pre-existing technology. In addition, the Act requires a license applicant to make a commitment to achieve practical utilization of the invention within a reasonable time and requires periodic reporting on the use of the invention by the licensee only to the extent necessary to enable the Federal agency to determine whether the licensee is complying with license terms.

The CRADA's Role in Technology Transfer

As recently stated by the House Science and Technology Committee, "A CRADA, as envisioned at the time of the passage of the Federal Technology Transfer Act of 1986, was designed to help move individual ideas from the Federal laboratories into the private sector or lead to cooperation between industry and government labs in areas of mutual interest..."[16]

A CRADA is an agreement between one or more Federal laboratories and one or more non-federal parties. Under a CRADA, the government laboratories provide personnel, services, facilities, equipment or other resources with or without reimbursement. However, funds cannot be transferred from the federal partner to the non-federal partner. The non-federal parties provide funds, personnel, services, facilities, equipment or other resources toward the conduct of specified research and development efforts that are consistent with the missions of the laboratory. The CRADA partners share in the intellectual property developed under the effort. A CRADA is not a procurement contract or a cooperative agreement as Section 6303 et seq. of Title 31 of the United States Code uses these terms. Consequently, in awarding a CRADA to a collaborating party, the laboratory director is not required to comply with the FAR.[17] However, a CRADA is a legally binding document.

Under federal law, works created by employees of the Government cannot, except in rare circumstances, be copyrighted (17 U.S.C.§ 101-801, Copyrights). Works created under this agreement solely by the collaborating party or jointly with employees of the Federal laboratory may be copyrighted and owned by the collaborating party. The Government requires a non-exclusive, irrevocable, paid-up, worldwide license in all copyrighted software or other works developed under the CRADA. This license would enable the Government to use, duplicate, or disclose the copyrighted works for Government purposes only. Congress is considering changes to the law that would permit the Government to copyright software created under the CRADA by employees of the Federal laboratory.[18]

Guidelines for Developing a CRADA

- CRADAs are agreements that allow one or more Federal laboratories and one or more non-federal parties to conduct specified R&D efforts that are related to and consistent with the DoD laboratory/activity's mission.
- CRADAs are not subject to terms for procurement contracts as required by 31 USC 6303-6305, but are contracts in the same sense that they are legally enforceable.
- Special consideration is to be given to small businesses or consortia involving small businesses.
- Preference should be given to businesses located in the U.S. or those which agree that products embodying inventions made under the CRADA or produced through the use of such inventions will be manufactured substantially in the U.S.
- CRADAs must contain provisions for a variety of intellectual property issues including data rights, property ownership, and the allocation of rights to future inventions/intellectual property.
- DoD laboratories may protect from public access certain commercially valuable information resulting from work under a CRADA for a period of up to five years.
- DoD laboratories can commit resources such as personnel, services, facilities, equipment, intellectual property or other resources with or without reimbursement, but cannot provide funds as part of the agreement. Non-federal parties can commit funds to the agreement as well.
- DoD laboratories receiving funds under a CRADA should maintain separate and distinct accounts, records and other evidence supporting expenditures under the CRADA.
- When licensing intellectual property, the DoD laboratory shall, at a minimum, retain a nonexclusive, nontransferable, irrevocable, paid-up license for use by the Government.
- The private non-federal partner must be given the option to choose an exclusive license for a prenegotiated field of use for any invention made in whole or in part by a laboratory employee.
- CRADAs shall be accomplished without actual or apparent personnel or organizational conflict of interest or violations of ethics standards.

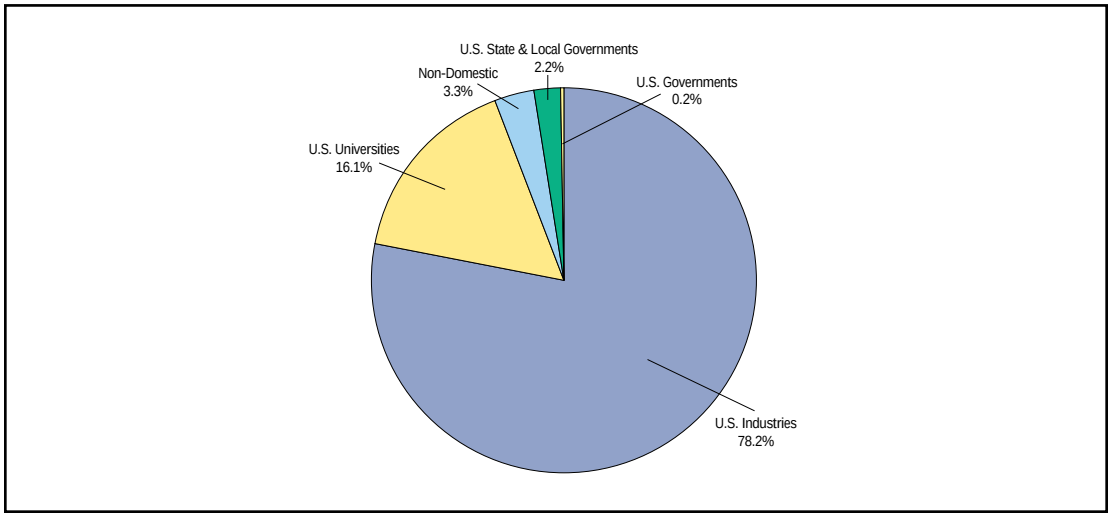
In certain instances, the Government may require the collaborating party to share with the Federal laboratory income received as a result of the sale or use of copyrighted works created under the CRADA. The length of time such payments remain in effect is negotiable, and in most instances the payments continue even after the termination of the CRADA.[19]

The table of guidelines and factors, provided here and laid out in the legislation, are to be considered when using a CRADA.[20]

The Use of CRADAs:

The flexibility of the CRADA mechanism makes it one of the most important tools for partnerships. CRADAs are being used in new and creative ways such as for facility share agreements and even some personnel exchanges.

As shown in Figure 2, there is a broad mix of users of the CRADA mechanism. The industry sector is the largest user which includes both small and large businesses.



Source: DTTIS

Total Count: 1774 (1039 active)
1995-June 1998

Figure 2. Users of Defense CRADAs

A prior study[21] showed that there are different motivations for government and industry in joining a CRADA. Reasons laboratories have for engaging in TT activities include: 1) meeting legislative and OSD policy requirements, 2) improving laboratory quality and image by accessing commercial expertise and interacting with state and local R&D organizations, 3) enhancing mission capabilities by leveraging R&D dollars and by accessing commercial technologies and resources, and 4) contributing to the national economic well being by providing public access to DoD sponsored technologies.

In a survey conducted by Alden Bean, Lehigh University and J. David Roessner, Georgia Institute of Technology, Chief Technical Officers (CTOs) and laboratory or R&D Division Directors were queried on the factors involved in making the decision to collaborate with a Federal laboratory rather than with another external resource. These industry participants were gathered from the Industrial Research Institute (IRI), a professional trade association in Washington, DC. The IRI membership consists of approximately 270 large, research-intensive companies that account for 85% of R&D performed by U.S. industry. The survey showed that "companies are seeking technical information, expertise, access to specialized equipment, and new technology from outside sources in response to market pressure, tighter company budgets, and globalization of competition."[22]

Although this survey studied interactions in general between companies and the Federal laboratories and not just technology transfer interactions, cooperative research was ranked second in the types of interactions providing the highest payoff. Other types of interactions included: contract research, workshops/seminars/briefings, licensing of laboratory technology to industry, technical consultation, use of laboratory facilities, laboratory visits and information dissemination. "Informal interactions such as information dissemination, lab visits, seminars, and technical consultation occurred most frequently. The least frequent means of interaction were those that required the most paperwork, greatest investment of time, or greatest potential loss of research productivity such as technology licensing and employee exchange. Since a prior survey conducted in 1988, the frequency of interactions increased across the board with the greatest increases in contract research, cooperative research, and licensing suggesting that the legislative incentives intended to foster cooperative research with potential commercial applications are having a positive effect."[22]

The results from the survey went further to distinguish that leveraging of R&D, access to expertise and facilities, and business opportunities were the types of payoffs that can be expected from cooperative R&D. It was interesting to note that responses to this survey indicated that the most prevalent reason for industry interacting with a Federal laboratory was "access to unique technical resources." Some observers have assumed that commercialization potential would be the primary reason for industry/laboratory interactions, however, the survey found that it has only a "slightly positive" influence.

Since the 1986 authorization for DoD use of the CRADA mechanism, their use has increased dramatically as shown in Figure 3. This increase is due in part to increased familiarity with the mechanism, discovering the many types of collaborations that can be handled through the CRADA mechanism as well as the streamlining of the CRADA process through the delegation of signing authority and the development of Standard (Model) CRADA.

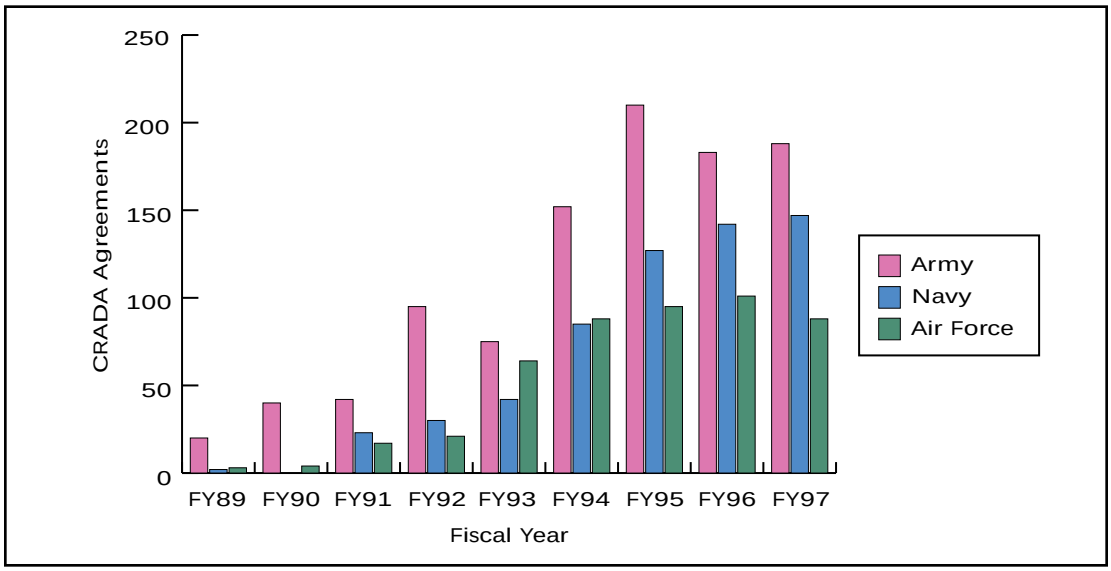


Figure 3. Defense CRADAs by Service
(Source: TT Service Managers)

One opinion is that the "rapidly rising curve of CRADA counts will level off as industry exploits the most promising opportunities for cooperative research."[23] Although this statement has some merit, as more industries become familiar with the technological potential that lies within the Federal laboratories as well as how to do business with the Federal laboratories, the use of the mechanism should continue to rise.

There are a number of "types" of CRADAs that have emerged since the inception of the CRADA mechanism. These versions of the CRADA have been developed to further simplify how industry can partner with the DoD.

The "Standard" CRADA, sometimes called the Model CRADA, permits the delegation of some CRADA signing authority to the laboratories which has streamlined the CRADA process tremendously. The standard CRADA permits automatic or accelerated approval, provided the language of the CRADA has not been modified (and/or a funding ceiling has not been exceeded). The Army, Navy, and Air Force, and sometimes the individual laboratories themselves, have slightly different standard CRADAs. Although the CRADA process is streamlined for the most part, the variation among the standard CRADAs can create difficulty in cooperation in those rare occasions when an additional Service joins a CRADA project (a new CRADA must be generated and signed). [24]

A "Blanket" CRADA, also referred to as a Master or Umbrella CRADA, is one of the variations on the CRADA mechanism gaining in popularity. Under this instrument, a CRADA is signed with an entire entity, like a county chamber of commerce, an association of small businesses, or an industry association. Usually these CRADAs are for technical assistance and often lead to traditional ("full blown") CRADAs for more sustained support. A blanket CRADA is unique in that it can set the stage for long term collaborations and facilitate complex strategic partnerships. To start a new effort, only the statement-of-work needs to be changed. The Army and Navy are pioneering this instrument.

For example, the Big Three automakers (Ford, General Motors, and Chrysler) have signed a blanket CRADA with the U.S. Army Tank-Automotive Research, Development and Engineering Center thereby fast-tracking future R&D between the automakers and the Army. The blanket concept has worked well for these partners in part because both industry and government had similar technical interests and the industries were located in close proximity to each other. Before this CRADA was established there was little interaction between the auto industry and the Army, despite similar needs; now this has changed significantly.

There are two additional types of CRADAs, the Technical Assistance CRADA and the Military Use CRADA, that are specifically defined in the DoD Draft Instruction on Technology Transfer.

The Technical Assistance CRADA allows a Federal laboratory and a non-federal partner to work jointly to assist local businesses by providing limited (4 day maximum) free technical consulting. In this case the non-federal partner is a state organization, university, non-profit entity, or business incubator that publicizes availability of federal assistance, receives and assesses requests for cooperative research, ensures the laboratory is not competing with private organizations and coordinates the laboratory's work with the requester companies. The laboratory provides the required assistance and reports to the CRADA partner and the requester company. The requester company merely provides a problem statement and signs a short 2-page "mini-CRADA" agreement.[25] The CRADA formed between the Naval Surface Warfare Center, Dahlgren Division and the Virginia Center of Innovative Technology (N9) is an example from this study of a Technical Assistance CRADA.

Some Services use CRADAs to develop technology specifically for military use/insertion. It has been argued that this may not be in keeping with the original intent of CRADA legislation, which is to develop commercial spin-offs. However, this type of CRADA use does fit with the goal of using CRADAs to extend diminishing laboratory resources toward fulfilling the military mission.[5] This type of CRADA, the Military Use CRADA, is an agreement between a DoD laboratory and an industrial partner to utilize existing unique capabilities and facilities at a DoD laboratory in a process or product intended primarily for DoD or other military use. Each participant recognizes that it cannot support the research alone and that duplicate existing research or facilities do not exist.[25] Two examples from this study that illustrate the Military Use CRADA were both at the Air Force Development Test Center, Eglin, AFB; one with Eastman Kodak (AF7) and the other with Hughes Missile Systems (AF9) (see appendices). In each of these CRADAs DoD testing facilities were used to demonstrate a particular capability of specific value to DoD.

Material Transfer Agreements, MTAs, although not actually CRADAs and therefore not included in the official CRADA counting process, are sometimes referred to as "CRADAs for Material Transfer (CRADA-MT)." These agreements are used when: 1) a party is providing material or information to a laboratory; 2) no collaboration beyond the transfer of the material or information is contemplated; 3) the laboratory is only to screen, test, or evaluate the material or information and provide a report of the results to the party providing the material; and 4) no funds, personnel, equipment or other resources are provided to the laboratory. The screening, testing and evaluating of the other party's material or information could result in new intellectual property and subsequent patent applications owned by the U.S. Government or jointly owned by the interacting but "noncollaborating" parties. Therefore, a service is not merely provided to the other party in a CRADA-MT, but research is conducted relevant to the laboratory's mission with the supplied materials. Even though no formal collaboration is intended, the inventive process, working in its own way, may result in joint inventions.